

Claims

1. An axial fan (1), rotating in a direction (V) in a plane (XY) about an axis (2), comprising a central hub (3) with a centre (O) and a radius Rmin, a plurality of blades (4) each having a root (5), a tip (6) which extends to a tip radius (Rmax), the blades (4) being delimited by a concave leading edge (7) and a convex trailing edge (8), and being formed by several aerodynamic profiles (12 - 16) relative to sections at various intervals along the radial extension of a blade (4), each profile (12 - 16) being formed by a centre line (L1) which is continuous without points of inflection or cusps, the axial fan being characterised in that the length of the centre line (L1) for each profile (12 - 16) is defined by a percentage range relative to the maximum radius Rmax of the fan (1) as indicated in the following table:

Profile (Reference)	% radial position (% of blade extension = % of Rmax-Rmin)	L1 % range (centre line % range relative to Rmax)	
12	0	35.5%	43.4%
13	26.25	43.1%	52.6%
14	50.87	48.8%	59.6%
15	75.46	55.5%	67.8%
16	100	62.1%	75.9%

2. The axial fan (1) according to claim 1, characterised in that each profile (12 - 16) is formed by an axial extension with percentage length ranges relative to the maximum radius Rmax of the fan (1) as indicated in the following table:

Profile (Reference)	% radial position (% of blade extension = % of Rmax-Rmin)	Axial extension - % ranges relative to Rmax	
12	0	25.5%	31.2%
13	26.25	24.4%	29.8%
14	50.87	23.2%	28.4%
15	75.46	22.2%	27.1%
16	100	21.4%	26.1%

3. The axial fan (1) according to claim 1 or 2, characterised in that the leading edge (7) comprises a first circular arc segment (9) close to the root (5) with a radius which is between 68.9% and 84.3% of the tip radius (R_{max}) and a second circular arc segment (10) close to the tip (6) with a radius which is between 32% and 39% of the tip radius (R_{max}), and a radius at the change between the two circular arc segments (9, 10) which is between 38.3% and 46.9% of the extension ($R_{max} - R_{min}$) of the blade (4).
4. The axial fan (1) according to any of the foregoing claims, characterised in that the trailing edge (8) comprises a circular arc segment (11) with a radius which is between 36.8% and 45% of the tip radius (R_{max}).
5. The axial fan (1) according to any of the foregoing claims, characterised in that the leading edge (7) comprises a first circular arc segment (9) close to the root (5) with a radius which is 76.6% of the tip radius (R_{max}) and a second circular arc segment (10) close to the tip (6) with a radius which is 35.5% of the tip radius (R_{max}), and a radius (R_1) at the change between the two circular arc segments (9, 10) which is 42.6% of the extension ($R_{max} - R_{min}$) of the blade (4).
6. The axial fan (1) according to any of the foregoing claims, characterised in that the trailing edge (8) comprises a circular arc segment (11) with a radius which is 40.9% of the tip radius (R_{max}).
7. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) has an amplitude, at the root (5), with an angle (B_1) relative to the centre (O) of between 36.9 and 45.1 degrees.
8. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) has an amplitude, at the tip (6), with an angle (B_2) relative to the centre (O) of between 33.3 and 40.7 degrees.

9. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) has an amplitude, at the root (5), with an angle (B1) relative to the centre (O) of around 41 degrees.

10. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) has an amplitude, at the tip (6), with an angle (B2) relative to the centre (O) of around 37 degrees.

11. The axial fan (1) according to any of the foregoing claims, characterised in that, considering the projection of the blade (4) in the plane (XY) and fan (1) direction of rotation (V), the tip (6) is further forward than the root (5) by an angle (B3) relative to the centre (O) of around 15.6 degrees.

12. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) forms a point (M) of intersection between the trailing edge (8) and the hub (3) with an angle (B4) of 26 degrees, the angle (B4) being formed by the respective tangent to the trailing edge (8) at the point (M) and by a respective line from the centre (O) of the fan (1) passing through the point (M).

13. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) forms a point (N) of intersection between the trailing edge (8) and the tip (6) with an angle (B5) of 59 degrees, the angle (B5) being formed by the respective tangent to the trailing edge (8) at the point (N) and by a respective line from the centre (O) of the fan (1) passing through the point (N).

14. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) forms a point (S) of intersection between the leading edge (7) and the hub (3) with an angle (B6) of 22 degrees, the angle (B6)

being formed by the respective tangent to the leading edge (7) at the point (S) and by a respective line from the centre (O) of the fan (1) passing through the point (S).

5 15. The axial fan (1) according to any of the foregoing claims, characterised in that the projection of the blade (4) in the plane (XY) forms a point (T) of intersection between the leading edge (7) and the tip (6) with an angle (B7) of 57 degrees, the angle (B7) being formed by the respective tangent to the leading edge (7) at the point (T) and by a respective line from the centre (O) of the fan (1) passing through the point (T).

15 16. The axial fan (1) according to any of the foregoing claims, characterised in that each profile (12 - 16) is formed by two angles (BLE, BTE) of incidence with the leading edge and the trailing edge, the angles being formed by the respective tangents to the centre line (L1) at the point of intersection with the leading edge and with the trailing edge and a respective straight line perpendicular to the plane (XY) passing through the corresponding points of intersection and also being characterised in that the angles (BLE, BTE) of the profiles (12 - 16) have the values indicated in the following table:

Profile	Radial position %	Radius (mm)	BLE (degrees)	BTE (degrees)
12	0	27.5	65	20
13	26.25	40.6	72	30
14	50.87	52.9	75	42
15	75.46	65.2	77	50
16	100	77.5	79	55

25 17. The axial fan (1) according to any of the foregoing claims, characterised in that each profile (12 - 16) is defined by the values of the positions (in mm) relative to an axis (Z) perpendicular to the plane (XY), taking the lower edge of the hub 3 as a reference, expressed in the following table:

Profile (Reference)	Leading edge mm (Ref. 7)	Trailing edge mm (Ref. 8)
12	22.4251	0.474211
13	22.9038	1.92382
14	22.6888	2.66545
15	21.8639	2.75294
16	20.6228	2.20486

18. The axial fan (1) according to any of the foregoing claims, characterised in that each profile (12 - 16) has a thickness S-MAX arranged symmetrically relative to the centre line (L1) and has values within the range of between 2.81% and 2.88% of the tip radius Rmax.

19. The axial fan (1) according to claim 18, characterised in that the profiles (12 - 16) have a thickness which is arranged symmetrically relative to the centre line (L1) and a thickness trend that is initially increasing, a maximum value S-MAX at around 20% of the length of the centre line (L1), and then gradually decreasing as far as the trailing edge (8) and also being characterised in that the thickness trend is defined by the following table:

Profile	Radial position %	Radius (mm)	Thickness						
			S-MAX (mm)	dimensionless relative to S-MAX					
				0% L1	20 % L1	40% L1	60% L1	80% L1	100% L1
12	0	27.5	2.18	0.570765	1	0.844404	0.703746	0.598529	0.10986
13	26.25	40.6	2.23	0.600601	1	0.89373	0.763659	0.622563	0.126933
14	50.87	52.9	2.23	0.642517	1	0.921272	0.803741	0.652252	0.145792
15	75.46	65.2	2.21	0.689833	1	0.93394	0.81485	0.655626	0.16592
16	100	77.5	2.19	0.737872	1	0.920047	0.782595	0.624287	0.186373

20. The axial fan (1) according to any of the foregoing claims, comprising seven blades (4) arranged at angles that are not equal; said angles, expressed in degrees, between one blade (4) and another - considering for example the corresponding leading edges (7) or trailing edges (8) - are: 51; 106; 157; 204; 259; 311.